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Studies of Extended Planetary Atmospheres

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Strategy

Telescopic observation and analysis of planetary atmospheres (including Moon and Mercury) and the Io torus; occultation observations; supporting laboratory studies.

Progress and Accomplishments

Further observations of sodium and potassium in the lunar atmosphere have shown that the scale height is nearly always large, corresponding to temperatures between 600 and 1000 K, although data from 1988 were close to the expected 350 K. We published a model (Kozlowski et al.) fitting these results by the postulate that most atoms adsorb to the surface for a large fraction of a second, to be released by photodesorption in which excess photon energy goes into kinetic energy of the released atom. These results were also reported at the DPS, as well as an invited review by Hunten. Many of our observing runs during 1990 were clouded out, but the data we have are mostly reduced.

In the occultation program, analysis of the Titan results is nearly complete and a paper is in preparation. A single successful observation of Kleopatra was obtained in Colorado, but without additional chords it is not of great value. An expedition to Florida early in January 1991 to observe Vesta was rained out. Apart from some bugs that have now been repaired, the data systems are performing well.

A report of a potassium enhancement over Caloris on Mercury is now published (Sprague et al.) but the interpretation appears to be controversial. We still believe that enhanced degassing is strongly preferable to the proposed alternative by Killen et al, which invokes auroral effects.

Water vapor on Mars was mapped at four epochs during the last apparition. The seasonal behavior resembles that obtained during the Viking epoch, although other years have been different. A paper is in press (Rizk et al.).

The work on intra-cavity laser spectroscopy of methane is going extremely well but very slowly in light of Wells's many other duties.

Projected Accomplishments

Observations and analysis of sodium and potassium on the Moon and Mercury will continue. We are in the midst of building a true coronagraph with a 15 cm aperture to enhance the lunar observing, with reduction of scattered light and a plate scale more suited to the size of the atmosphere. The Mars water-vapor observations are continuing, and we hope in addition to search for the excess water vapor observed in the subsolar region by the Pioneer Venus Infrared Radiometer. We continue to collaborate with N. Schneider, now at the University of Colorado, in observations of the Io system at the 61-inch. These will include an attempt to repeat his spectacular absorption spectra of Io's atmosphere, obtained by observing another satellite as Io eclipsed it.

Publications

R.W. Kozlowski et al. (K on moon), GRL 17, 2253 (1990); A.L. Sprague et al. (Caloris) Science 249, 1140 (1990); Rizk et al. (Mars water), Icarus, in press. Sprague et al. are preparing a comprehensive paper on the lunar work.